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# *HEATHROW SLIGHTLY STEEPER APPROACHES: INITIAL OPTIONS APPRAISAL CAP1616 STAGE 2B*

Version 1.0

Heathrow

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# *DOCUMENT CONTROL*

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|---|---|
| TITLE | Heathrow Slightly Steeper Approaches: Initial Options Appraisal CAP1616 Stage 2B |
| STATUS | Final |
| CLASSIFICATION | Public |
| AUTHOR | Heathrow Airport |
| DATE | 07/02/2020 |
| VERSION | V1.0 |

 

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# CONTENTS



## APPENDICES



 

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# 1. INTRODUCTION

## 1.1 Slightly Steeper Approaches

1.1.1 This document is the Stage 2B submission '*Initial Options Appraisal*' (IOA) for the Slightly Steeper Approaches (SSA) airspace change proposal under the CAP1616[1] Airspace Change Process (ACP). More information regarding this airspace change and the documents preceding this report can be found on the Civil Aviation Authority (CAA) airspace change portal[2].

## 1.2 Airspace Change Process

1.2.1 CAP1616 is the guidance material provided by the CAA that describes the minimum requirements for the seven-stage airspace change process used for permanent changes to the published airspace design. Figure 1 displays the full ACP process as defined in CAP1616, illustrating where this document fits into the process.

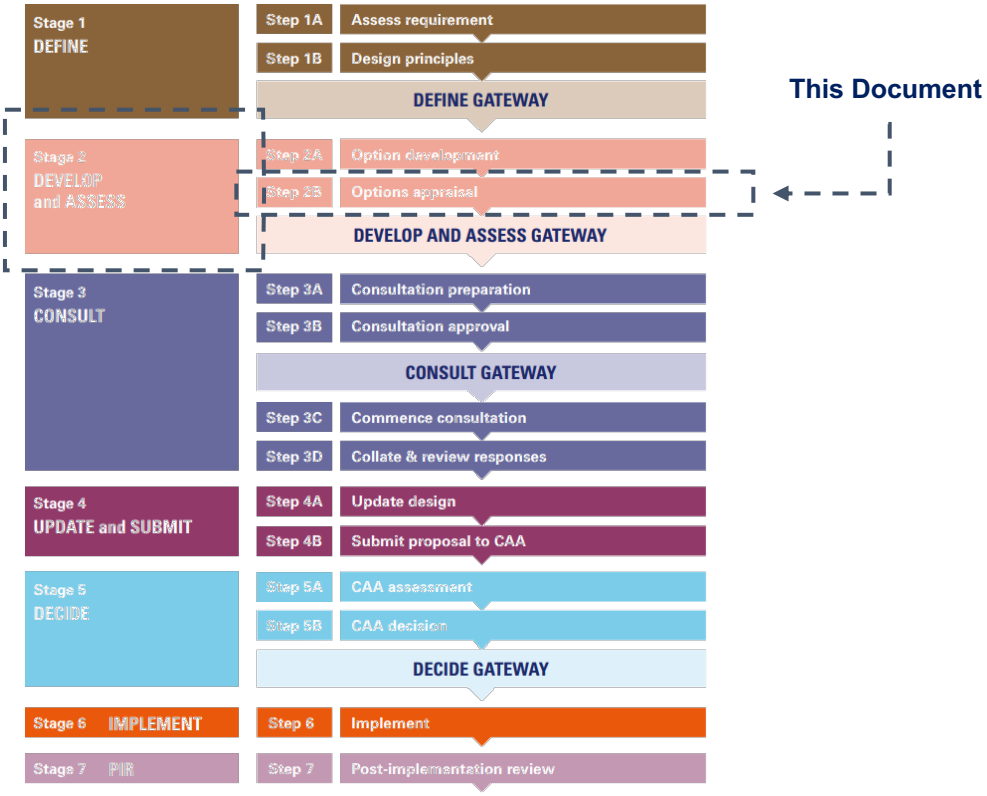


*Figure 1: CAP1616 Stages*

[1] CAP1616 Airspace Design: Guidance on the regulatory process for changing airspace design including community engagement requirements:
https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=8127

[2] CAA airspace change portal:
https://airspacechange.caa.co.uk/PublicProposalArea?pID=17

 

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## 1.3 Options Under Assessment

1.3.1 Stage 2A of the CAP1616 process requires sponsors to develop a comprehensive list of flight path options, to the extent that a list is possible, in accordance with the design principles, engage stakeholders on the development of the initial comprehensive list, respond to feedback, and then perform a design principle evaluation of all options. Heathrow's Stage 2A submission was submitted to the CAA in February 2020.

1.3.2 As a result of this process, four options for Area Navigation (RNAV) approaches were explored as below:

- **RNAV Approach Option B1** – Do nothing, maintain RNAV and ILS approaches with Vertical Path Angle (VPA) at 3.0˚ (Baseline);
- **RNAV Approach Option B2** – Increase RNAV VPA to 3.2˚, maintain ILS VPA at 3.0˚;
- **RNAV Approach Option B3** – Increase RNAV VPA to 3.5˚, maintain ILS VPA at 3.0˚;
- **RNAV Approach Option B4** – Segmented RNAV approach with a VPA from 4.5˚ reducing to 3.2˚, maintain ILS VPA at 3.0˚.

1.3.3 All options for steeper Instrument Landing System (ILS) approaches were discounted as non-viable[3].

1.3.4 A single viable option (B2: Increase RNAV VPA to 3.2˚, maintain ILS VPA at 3.0˚) was identified to be taken forward into Stage 2B.

## 1.4 Baseline

1.4.1 CAP1616 requires the change sponsor to define a baseline, against which the cost and benefits of an airspace change can be assessed. For the purpose of this Initial Options Appraisal, the baseline is set as the 'do-nothing option'.

1.4.2 The following assumptions have been made when defining the 'do-nothing option':

- **Assessment period under consideration is between 2021 and 2025[4]**, when this ACP is planned to be superseded[5].

[3] Option identification is fully described in Section 2 of the document '*Heathrow's Slightly Steeper Approach – Stage 2A Options Development*'.
[4] Full Options Appraisal sensitivity analysis will include an assessment out to 2031, in line with CAP1616 guidance.
[5] In 2025, airspace changes concerning the development of controlled airspace, departure and arrival procedures related to the introduction of a third runway at London Heathrow Airport are planned to be introduced, superseding this ACP. Further details can be found using the following link: https://www.caa.co.uk/Commercial-industry/Airspace/Airspace-change/Decisions-from-2018/London-Heathrow-airspace-departure-and-arrival-procedures/.

 

- **SSA is considered a standalone ACP**. No other ACPs shall be considered in this Initial Options Appraisal[6].
- **Traffic levels shall remain constant throughout the assessment period**. This assumes the present 480,000 movements per annum cap remains in place and the introduction of 3.2˚ RNAV approaches has '*no impact'* on Heathrow airport's landing rate[7].
- **RNAV usage rates remain constant throughout the assessment period**. RNAV approaches result in a higher ATC and pilot workload and are presently flown by fewer than 2% of Heathrow's arrivals[7] (the remainder land using an ILS approach). Therefore, even if more crews (above 2% of arrivals) elected to fly RNAV approaches, ATC might not be able to accommodate and could decline pilot requests.

1.4.3 RNAV Approach Option B1 (RNAV and ILS Vertical Path Angle (VPA) at 3.0˚) is the baseline for this Initial Options Appraisal, referred hereafter as 'the Baseline'.

## *1.5 Stage 2B: Options Appraisal*

1.5.1 Stage 2B requires the change sponsor to carry out an 'initial' appraisal of the impacts of each of the options identified in Stage 2A. This is the first of three iterative phases of options appraisal.

1.5.2 The initial appraisal should, as a minimum, contain qualitative assessments of the different options. This highlights to change sponsors, stakeholders and the CAA the relative differences between the impacts, both positive and negative, of each option.

1.5.3 As only a single viable option was identified during Stage 2A, in accordance with the established design principles, this appraisal shall directly assess that one option against the Baseline. An extensive list of assessment criteria has been developed that reflect the requirements of:

- CAP1616;
- WebTAG[8];
- Transport Act 2000[9].

[6] Standalone ACP. However, the assessment period is defined by the development of controlled airspace, departure and arrival procedures related to the introduction of a third runway at London Heathrow Airport, which shall supersede this ACP.
[7] 3.2° Slightly Steeper Approach Trial 2017 Final Report (May 2018), Trax International https://www.heathrow.com/content/dam/heathrow/web/common/documents/company/local-community/noise/reports-and-statistics/reports/operational-trial-reports/slightly-steeper-approach-trial/Heathrow_Slightly_Steeper_Approach_Trial_2017_Final_Report.pdf
[8] Transport analysis guidance (TAG): https://www.gov.uk/guidance/transport-analysis-guidance-webtag
[9] Transport Act 2000: http://www.legislation.gov.uk/ukpga/2000/38/contents

 

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1.5.4 Following the example set out in CAP1616 Appendix E, assessment criteria have been categorised using the following groups:

- Communities;
- Wider Society;
- General Aviation;
- General Aviation/Commercial Airlines;
- Commercial Airlines;
- Airports / Air Navigation Service Providers (ANSP).

1.5.5 Section 2 of this document presents each group of assessment criteria and the assessment performed. Where categories do not need to be considered further in this assessment, e.g. because they may not provide any distinction between the options, justification is provided.

## *1.6 Reference Documents*

1.6.1 The following publicly available documentation has been used, in addition to CAP1616, and are referenced in this document:

**(1)** 3.2° Slightly Steeper Approach Trial 2017 Final Report (May 2018), Trax International
https://www.heathrow.com/content/dam/heathrow/web/common/documents/company/local-community/noise/reports-and-statistics/reports/operational-trial-reports/slightly-steeper-approach-trial/Heathrow_Slightly_Steeper_Approach_Trial_2017_Final_Report.pdf

**(2)** 3.2° Slightly Steeper Approach Trial Report (Aug 2016), Trax International
https://www.heathrow.com/content/dam/heathrow/web/common/documents/company/local-community/noise/reports-and-statistics/reports/operational-trial-reports/slightly-steeper-approach-trial/Heathrow_Slightly_Steeper_Approach_Trial_Report.pdf

**(3)** TAG unit A3 Environmental Impact Appraisal
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/825064/tag-unit-a3-environmental-impact-appraisal.pdf

**(4)** TAG unit A4.1 Social Impact Appraisal
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/805253/tag-4.1-social-impact-appraisal.pdf

**(5)** TAG unit A4.2 Distributional Impact Appraisal
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/638644/TAG_unit_a4.2_distrib_imp_app_dec2015.pdf

1.6.2 References to these documents are indicated by either (1) or (2) etc, as appropriate, through the remainder of this document.

 

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# 2. OPTION B2: INITIAL APPRAISAL

## 2.1 Introduction

2.1.1 This section contains the initial appraisal of Option B2 (Increase RNAV VPA to 3.2˚, maintain ILS VPA at 3.0˚) presented under the assessment criteria headings referred to in paragraph 1.5.4.

2.1.2 RNAV approaches are presently used by a small percentage of Heathrow arrivals. During flight trials conducted between 2015 and 2017 less than 2% of arrivals used RNAV approaches.

2.1.3 At this stage of the CAP1616 process, the assessment is mostly qualitative.

## 2.2 Communities

| Group | Criteria | Type of Analysis | Description |
|---|---|---|---|
| **Communities** | **Noise Impact on Health and Quality of Life** | *Quantitative* | **Description:** CAP1616 Appendix B sets out detailed guidance on the assessment of noise, carbon, air quality and other environmental impacts.<br><br>**Assessment:** The Noise assessment is scoped in for Stage 2 of the CAP1616 process. Slightly Steeper Approaches may deliver noise benefits which the Integrated Design Team (IDT) has assessed at the Initial Options Appraisal stage. Noise assessment work at Stage 2 IOA has considered information gathered from Heathrow's steeper approach trials described in the following paragraphs.<br><br>*Study area*<br>The study area is defined by the locations used by Heathrow's steeper approach trials (2015 (2) and 2017(1)) which evaluated amongst other things, the potential noise improvements owing to the 3.2° steeper approach. During these flight trials measurements of aircraft noise event levels were taken below 27L approaches into Heathrow, specifically at Heathrow's fixed noise monitoring terminals at Mogden Sewage Works (NMT129), Mid-Surrey Golf Course (NMT130), and Roehampton Golf Club (NMT131). |

 

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| Group | Criteria | Type of Analysis | Description |
|---|---|---|---|
| | | |  <br>*Figure 2: NMT locations under 27L final approach - Source (1)*<br><br>These locations therefore form the Stage 2 noise study area.<br><br>*Methodology*<br>Sound Exposure Levels (SEL)[10] of aircraft using the 3.2° RNAV SSA have been compared against those using the 3.0° conventional ILS approach. This comparison is taken from both steeper approach trials. From this comparison, the average change in aircraft SEL has been determined and provides an indication in the improvements in aircraft noise event levels as a result of aircraft operating the 3.2° RNAV SSA.<br><br>*Reasoning*<br>The use of data obtained from trials to support the initial options appraisal provides actual measured data of the performance of the 3.2° RNAV SSA compared to the existing conventional 3.0° ILS approach. This evidence therefore provides a strong indication of the noise improvements that would occur with the permanent implementation of the SSA for future operations and under Heathrow's other approach routes.<br><br>The use of information taken from the trial reports also helps confirm that there will be no change to ground tracks as a result of introducing the new approach. This therefore helps confirm that the introduction of the SSA will not result in a redistribution of noise.<br><br>The SEL measure is used in the modelling and assessment of noise exposure (in terms of LAeq) as required by WebTAG. As such, any improvement in SEL is indicative of the potential of 3.2° RNAV SSA to contribute towards the Government's aviation noise policy objective to *"limit and, where possible, reduce the number of people in the UK significantly affected by adverse impacts from aircraft noise"* as measured by WebTAG. |

[10]The single event Sound Exposure Level is the sound level in dBA which, if maintained for a period of one second, would cause the same A-weighted sound energy to be received as is received from a given sound event.

 

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<table>
<tr><th>Group</th><th>Criteria</th><th>Type of Analysis</th><th>Description</th></tr>
<tr><td></td><td></td><td></td><td>
Criteria<br>
The criteria used at Initial Options Appraisal for noise is:<br>
1. Differences in average measured aircraft SEL at NMT129, NMT130 and NMT131 between approaches using the 3.2° RNAV SSA compared to the existing 3.0° ILS approach; and<br>
2. Ground track comparisons of aircraft arrivals using the SSA compared to the existing 3.0° ILS approach.<br><br>
These criteria are representative of the measures used to evaluate potential noise benefits during the trials.<br><br>
Models used<br>
No modelling has been used at Stage 2 IOA. All data required for the IOA has been taken from published 2015 (2) 2017 (1) trial reports and which are based on data obtained from Heathrow's Airport Noise Monitoring and Management (ANOMS) Noise and Track Keeping System.<br><br>
Metrics and results<br>
The following metric has been used at the Stage 2 IOA:<br>
1. Average aircraft SEL differences (between 3.2° RNAV SSA and 3.0° ILS approaches).<br><br>
These are presented in Table 1 and are the results reported in Heathrow's two SSA trials (2) and (1).<br><br>
<table>
<tr><th>Trial</th><th>NMT129<br>Mogden Sewage Works<br>c3.7nm from touchdown<br>c78ft higher with SSA</th><th>NMT130<br>Mid-Surrey Golf Club<br>c4.7nm from touchdown<br>c100ft higher with SSA</th><th>NMT131<br>Roehampton Golf Club<br>c7.2nm from touchdown<br>c153ft higher with SSA</th></tr>
<tr><td colspan="4">Average Differences in Aircraft Noise Events, Sound Exposure Level (SEL dBA)</td></tr>
<tr><td>First Trial</td><td>-0.25 dB</td><td>-0.49 dB</td><td>-0.74 dB</td></tr>
<tr><td>Second Trial</td><td>-0.32 dB</td><td>-0.55 dB</td><td>-0.68 dB</td></tr>
</table>
Table 1: Stage 2 Noise Results (1)<br><br>
Summary: Whilst an average reduction of 0.51 dBA, the change in SEL is unlikely to be perceptible from the ground; the introduction of 3.2° RNAV approaches is an incremental step to reducing the impact of Heathrow airport's noise footprint on health and quality of life.
</td></tr>
</table>

 

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## Heathrow Slightly Steeper Approaches – Initial Options Appraisal

| Group | Criteria | Type of Analysis | Description |
|---|---|---|---|
| **Communities** | **Air Quality** | *Qualitative* | **Description:** CAP 1616 Appendix B sets out detailed guidance on the assessment of noise, carbon, air quality and other environmental impacts. A full assessment of air quality impacts is set out in WebTAG unit A3 (3).<br><br>**Assessment:** CAP 1616a (page 32) provides guidance on local air quality and it requires an assessment:<br>*"only where there is the possibility of pollutants breaching legal limits following the implementation of an airspace change (or worsening an existing breach of legal limits). The CAA deems that this is only likely to become a possibility where:*<br>*- There is likely to be a change in aviation emissions (by volume or location) below 1,000 feet, and*<br>*- The location of the emissions is within or adjacent to an identified AQMA".*<br><br>Air Navigation Guidance 2017 (paragraph 3.28) also states that aircraft *"…above 1,000 feet are unlikely to have a significant impact on local air quality."* Therefore, air quality only needs to be considered where an airspace change proposal affects aircraft movements at 1,000ft and below.<br><br>Heathrow is within the Hillingdon Air Quality Management Area (AQMA) and adjacent to other AQMAs, however, changes in emissions below 1,000ft as a result of SSA are considered negligible as there will be no changes to the current lateral flight paths of arriving aircraft to Heathrow, and no change in the number of air traffic movements. This is evidenced by the flight trials conducted between 2015 (2) and 2017 (1).<br><br>In addition, with regard to air quality and compliance with the annual mean Air Quality Objectives for nitrogen dioxide ($NO_2$), it is anticipated that the RNAV approaches introduced by this airspace change will be flown by fewer than 2% of arrivals to Heathrow. The small percentage of aircraft use combined with no change to lateral flight paths means the use of 3.2° RNAV approaches will not lead to changes in ground-level concentrations of $NO_2$ averaged over the calendar year. The SSA airspace change proposal will therefore not significantly affect local air quality. The Air Quality assessment is scoped out for all Stages of the CAP 1616 process for SSA.<br><br>**Summary:** Air quality will not be a differentiator between the Baseline and Option B2. |

*Table 2: Communities Assessment Criteria*

 

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## 2.3 Wider Society

| Group | Criteria | Type of Analysis | Description |
|---|---|---|---|
| **Wider Society** | **Greenhouse Gas Impact** | *Qualitative* | **Description:** CAP1616 Appendix B sets out detailed guidance on the assessment of noise, carbon, air quality and other environmental impacts. The greatest effect on climate change from aviation is emissions of carbon dioxide ($CO_2$).<br><br>**Assessment:** Emissions of greenhouse gases arise from the combustion of aviation fuel. Rate of aviation fuel combustion is influenced by track length, lateral tracks, the number of air traffic movements, landing rate, aircraft holding and thrust.<br><br>The SSA airspace change proposal will not involve any changes to the track length or lateral flight paths of aircraft arriving at Heathrow, nor will it involve any increase in the number of air traffic movements as evidenced by the flight trials conducted between 2015 (2) and 2017 (1). It was further reported that during the flight trials 3.2° RNAV approaches had *'no adverse impact on the daily operation'* and *'no impact'* on Heathrow airport's landing rate, indicating that no increase in aircraft holding will arise as a result of the implementation of 3.2° RNAV arrivals (1).<br><br>Participating aircraft will fly higher for longer on approach to the airport. This may be marginally beneficial in respect of carbon emissions since less air resistance results in lower thrust and a lower rate of fuel burn. However, any reductions will be negligible as a result of SSA as it is anticipated that the RNAV approaches introduced by this airspace change will be flown by fewer than 2% of arrivals to Heathrow. The impact in terms of $CO_2$ emissions is, therefore, considered negligible and this environmental aspect is scoped out of the SSA airspace change proposal with no assessment undertaken.<br><br>**Summary:** Greenhouse gas impact will not be a differentiator between the Baseline and Option B2. |
| **Wider Society** | **Capacity/ Resilience** | *Qualitative* | **Description:** CAP1616 Appendix E: *'Sponsors should qualitatively assess the effect of the proposal on the overall UK airspace infrastructure'.*<br><br>**Assessment:** The introduction of 3.2° RNAV approaches will not impact the present movement cap on Heathrow Airport and there are no impacts on existing controlled airspace boundaries or airspace classifications. As such the introduction of 3.2° RNAV arrivals is expected to have a neutral impact on system capacity/resilience.<br><br>**Summary:** Capacity/resilience impacts will not be a differentiator between the Baseline and Option B2. |
| **Wider Society** | **Social Impact** | *Qualitative* | **Description:** WebTAG unit A4.1: '*Social impacts cover the human experience of the transport system and its impact on social factors, not considered as part of economic or environmental impacts'*. Social impacts include accidents, physical activity, security severance, journey quality, option and non-use values, accessibility and personal affordability (4).<br><br>**Assessment:** Following a review of TAG unit A4.1, all eight of the social impacts considered in WebTAG are scoped out and no assessment will be undertaken. Social impacts cover the impact of transport on social factors. Of the eight social impacts – accidents, physical activity, security, severance, journey quality, options and non-use values, accessibility, and personal affordability – none are applicable to airspace change as these are relevant to ground transportation and would not be affected by airspace change of any kind. The Social Impact assessment is scoped out for all stages of the CAP 1616 process for SSA.<br><br>**Summary:** Social Impact will not be a differentiator between the Baseline and Option B2. |

 

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## Heathrow Slightly Steeper Approaches – Initial Options Appraisal

| Group | Criteria | Type of Analysis | Description |
|---|---|---|---|
| **Wider Society** | **Distributional Impact** | *Qualitative* | **Description:** WebTAG unit A4.2: *'Distributional impacts (DIs) consider the variance of transport intervention impacts across different social groups. The analysis of DIs is mandatory in the appraisal process and is a constituent of the Appraisal Summary Table (AST). Both beneficial and /or adverse DIs of transport interventions need to be considered, along with the identification of social groups likely to be affected' (5).*<br><br>**Assessment:** Following a review of TAG unit A4.2, all eight of the distributional impacts considered in WebTAG are scoped out and no assessment will be undertaken. Distributional impacts cover the variance of transport intervention impacts across different social groups. As with social impacts, these are applicable to ground transportation and of the eight distributional impacts – user benefits, noise, air quality, accidents, security, severance, accessibility, and personal affordability – only noise and air quality have applicability to an airspace change. For the SSA airspace change proposal, the distributional impact of noise will be considered within the respective noise assessment, and for air quality, this has been scoped out of the environmental assessment. The Distributional Impact assessment is scoped out for all Stages of the CAP 1616 process.<br><br>**Summary:** Distributional impact will not be a differentiator between the Baseline and Option B2. |
| **Wider Society** | **Tranquillity** | *Qualitative* | **Description:** WebTAG unit A3: Tranquillity '*means the remoteness and sense of isolation, or lack of it, within the landscape. This can be affected and often determined by noise levels and visual amenity resulting from the absence of built development and intrusion from traffic'* (3).<br><br>**Assessment:** CAP1616 sets out that an assessment of tranquillity impacts should be undertaken in accordance with the WebTAG guidance on 'Landscape'. Tranquillity is often determined by noise levels and visual amenity.<br><br>For a tranquillity assessment, the potential implications for the tranquillity of nationally protected landscapes (National Parks and AONBs) and other areas identified through community engagement are to be considered in terms of potential overflight.<br><br>For the SSA airspace change proposal, given the limited changes to existing airspace movements, no change in adverse effects are expected in terms of noise and visual impact. There will be no change to the lateral flight paths of aircraft arriving at Heathrow, which is evidenced by the flight trials conducted between 2015 (2) and 2017 (1). There will be no increase in the number of air traffic movements through the SSA airspace change proposal. Lateral fight paths and the number of air traffic movements influence visual amenity and noise levels for sensitive receptors and thus the tranquillity experienced in these areas.<br><br>As there will be no change to existing lateral flight paths and no increase in the number of air traffic movements, the nationally protected landscapes of National Parks and AONBs as sensitive receptors will not be affected by the SSA airspace change.<br><br>There are likely to be very slight benefits offered by the reduction in noise, which will be captured under the noise assessment. However, the impact on tranquillity is considered to be negligible in terms of visual amenity and noise impact with no measurable change to National Parks and AONBs. The Tranquillity assessment is therefore scoped out for all Stages of the CAP 1616 process for SSA.<br><br>**Summary:** Tranquillity will not be a differentiator between the Baseline and Option B2. |

 

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| Group | Criteria | Type of Analysis | Description |
|---|---|---|---|
| **Wider Society** | **Biodiversity** | *Qualitative* | **Description:** Guidance on assessing impacts on Biodiversity are included in WebTAG unit A3, following advice provided by Natural England. WebTAG unit A3 provides advice on how to appraise the costs and benefits of transport schemes in terms of their effects on both biodiversity and earth heritage (geological) interests (3).<br><br>**Assessment:** The WebTAG approach is designed to correspond to general terrestrial/aquatic transport projects where land take and other associated effects would be considered as a matter of course.<br><br>For the SSA airspace change proposal, the potential effects on biodiversity are restricted to those associated with disturbance created (noise or visual disturbance) by aircraft landing at the airport and to potential effects of air quality on habitats. Research shows disturbance effects associated with aircraft typically occur during the landing and take-off cycle when an aircraft is flying at or below 500m (1,640 feet)[11].<br><br>Field survey results gathered between 2017 and 2019 for the Heathrow Expansion DCO, show that within 250m of the airfield perimeter (when aircraft are often well below 500m) various species are regularly present (badgers, otters, bat species, breeding and wintering birds, European eels, other mammals, and a range of terrestrial invertebrates). These species are therefore capable of showing tolerance to disturbance from existing low flying aircraft.<br><br>As the SSA airspace change proposal would not require any changes to the current lateral flight paths arriving aircraft fly on approach to Heathrow, and there would be no increase in the number of aircraft arriving at Heathrow, there is not potential for disturbance of biodiversity to increase. Therefore, the potential effects on designated sites through the deposition of nitrogen or through increases in the concentration of NOx are scoped out. The Biodiversity assessment is scoped out for all Stages of the CAP 1616 process for SSA.<br><br>**Summary:** Biodiversity will not be a differentiator between the Baseline and Option B2. |
| **Wider Society** | **Historic environment** | *Qualitative* | **Description:** WebTAG unit A3: '*The man-made historic environment ('heritage', or heritage resource, heritage assets) comprises:*<br>• *buildings (individually or in association) of architectural or historic significance;*<br>• *areas, such as parks, gardens, other designed landscapes or public spaces, remnant historic landscapes and archaeological complexes; and*<br>• *sites (e.g. ancient monuments, places with historical associations such as battlefields, preserved evidence of human effects on the landscape, archaeological sites and so on).*<br><br>*The historic environment also includes the sense of identity and place which the combination of these features provides'* (3).<br><br>**Assessment:** The assessment of impacts on the historic environment is not one of the five environmental aspects identified by CAP1616, however an assessment is suggested in paragraph B10 of CAP 1616 via WebTAG.<br><br>For the SSA airspace change proposal, an assessment of the historic environment is not required because the effects on heritage assets is considered to be negligible. There will be no change to the lateral flight paths of aircraft arriving at Heathrow, which is evidenced by the flight trials conducted between 2015 (2) and 2017 (1). There will be no increase in the |

[11] Drewitt, A. (1999) Disturbance effects of aircraft on birds. English Nature Birds Network Information Note

 

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| Group | Criteria | Type of Analysis | Description |
|---|---|---|---|
| | | | number of air traffic movements through the SSA airspace change proposal. It is also important to note that the RNAV approaches are presently flown by fewer than 2% of arrivals (the remainder flying on ILS approaches).<br><br>It is considered that the SSA noise improvements will not affect noise thresholds enough to significantly alter the contribution of setting to the significance of heritage assets. This is based on evidence from the trial reports. Therefore, the Historic Environment assessment is scoped out for all Stages of the CAP 1616 process for SSA.<br><br>**Summary:** Historic environment will not be a differentiator between the Baseline and Option B2. |
| **Wider Society** | **Landscape** | *Qualitative* | **Description:** WebTAG unit A3: '*Landscape means more than just 'the view'. It is both the physical and cultural characteristics of the land itself (i.e. its use and management) and the way in which we perceive those characteristics. It is this mix of characteristics and perceptions that make up and contribute to landscape character and give a "sense of place"* (3).<br><br>**Assessment:** As set out in CAP 1616, the WebTAG guidance for landscape (which is consistent with that for townscape, where relevant to airspace change) is applied to a tranquillity assessment. Landscape/townscape is therefore inherently taken into account in an assessment of tranquillity for airspace change. If the criteria were to be additionally applied to landscape and townscape topics there would be duplication of assessment, which would not be appropriate.<br><br>Given this, and as a tranquillity assessment has been scoped out of the SSA airspace change proposal, the Landscape assessment is scoped out for all Stages of the CAP 1616 process for SSA.<br><br>**Summary:** Landscape will not be a differentiator between the Baseline and Option B2. |
| **Wider Society** | **Townscape** | *Qualitative* | **Description:** WebTAG unit A3: '*Townscape is the physical and social characteristics of the built and non-built urban environment and the way in which we perceive those characteristics. It is this mix of characteristics and perceptions that make up and contribute to townscape character and give a 'sense of place' or identity'* (3).<br><br>**Assessment:** As set out in CAP1616, the WebTAG guidance for landscape (which is consistent with that for townscape, where relevant to airspace change) is applied to a tranquillity assessment. Landscape/townscape is therefore inherently taken into account in an assessment of tranquillity for airspace change. If the criteria were to be additionally applied to landscape and townscape topics there would be duplication of assessment, which would not be appropriate. Given this, and as a tranquillity assessment has been scoped out of the SSA airspace change proposal, the Townscape assessment is scoped out for all Stages of the CAP 1616 process for SSA.<br><br>**Summary:** Townscape will not be a differentiator between the Baseline and Option B2. |
| **Wider Society** | **Safety** | *Qualitative* | **Description:** Consider existing hazards and new hazards including mitigation strategies.<br><br>**Justification:** A successful outcome of the flight trials was defined by Heathrow as to have '*gathered sufficient data with no adverse impact to safety or operational performance',* considering '*Continuous descent approach performance, speed adherence on final approach, landing rates, runway occupancy time, numbers of go-arounds, landing gear deployment, aircraft tracks over the ground and to quantify the re-distribution of noise'* (1).<br><br>Feedback was gathered from Air Traffic Control (ATC) and Airlines, including safety observations. Two safety observations were raised during the first trial, neither attributable to the 3.2° RNAV approach, and none during the second trial. Flight trials |

 

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| Group | Criteria | Type of Analysis | Description |
|---|---|---|---|
| | | | conducted between 2015 and 2017 concluded that the trial '*met all objectives with no adverse impact on the daily operation'* (1), thus meeting the objective of '*no adverse impact to safety'* (1).<br><br>**Summary:** Safety will not be a differentiator between the Baseline and the Option B2. |
| **Wider Society** | **Water environment** | *Qualitative* | **Description:** Guidance on assessing impacts on the Water environment is included in WebTAG unit A3, which provides advice on how to appraise the costs and benefits of transport schemes in terms of their effects (3).<br><br>**Assessment:** Following a review of TAG unit A3, impacts on the water environment are scoped out and no assessment will be undertaken. The WebTAG guidance distinguishes between impacts arising from the construction of new transport infrastructure, and changes in the use pattern of existing infrastructure and states any transport scheme should fit into one, or both, categories.<br><br>An assessment of the impact on the water environment is not considered relevant for the SSA airspace change proposal as the airspace change will not result in any measurable effects on water receptors. This is because the SSA airspace change proposal would not require any changes to the current lateral flight paths arriving aircraft fly on approach to Heathrow, nor would it seek to increase the number of aircraft arriving at Heathrow. The Water environment assessment is scoped out for all Stages of the CAP1616 process for SSA.<br><br>**Summary:** Water environment will not be a differentiator between the Baseline and the Option B2. |

*Table 3: Wider Society Assessment Criteria*

## 2.4 General Aviation

| Group | Criteria | Type of Analysis | Description |
|---|---|---|---|
| **General Aviation** | **Access** | *Qualitative* | **Description:** CAP1616 Appendix E: '*Sponsors should qualitatively assess the effect of the proposal on the access to airspace for General Aviation'*. Also considered was the impact of the proposed airspace change on access to adjacent airspace. Including but not limited to; Gatwick, London City, Stansted, Luton, Farnborough, NATS en-route, Ministry of Defence, impact on London Airspace Management Programme (LAMP) / Future Airspace Strategy (FAS) / overall UK airspace infrastructure, and General Aviation (GA).<br><br>**Assessment:** There are no impacts on existing controlled airspace boundaries or airspace classifications or on traffic numbers with the introduction of 3.2° RNAV arrivals. As such Option B2 will not change the current impact on GA access.<br><br>**Summary:** Access will not be a differentiator between the Baseline and Option B2. |

*Table 4: General Aviation Assessment Criteria*

 

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## 2.5 General Aviation/Commercial Airlines

| Group | Criteria | Type of Analysis | Description |
|---|---|---|---|
| **General Aviation /Commercial Airlines** | **Economic impact from increased effective capacity** | *Qualitative* | **Description:** CAP1616 Appendix E: *'Forecast increase in air transport movements and estimated passenger numbers or cargo tonnage carried'*.<br><br>**Assessment:** There will be no change in traffic numbers due to the introduction of 3.2° RNAV arrivals, the present traffic cap of 480,000 movements per annum remains. Flight trials conducted between 2015 and 2017 reported '*no adverse impact on the daily operation'* and *'no impact'* on Heathrow airport's landing rate. (1). As such there is no change in effective capacity between the baseline and Option B2<br><br>**Summary:** Economic impact will not be a differentiator between the Baseline and Option B2. |
| **General Aviation /Commercial Airlines** | **Fuel burn** | *Qualitative* | **Description:** CAP1616 Appendix E: '*Fuel costs and the relative efficiency of aircraft are readily obtainable from market data. The change sponsor must seek to quantify and monetise these costs based on its assumptions of the fleets in operation'*.<br><br>**Assessment:** Flight trials conducted between 2015 and 2017 demonstrated '*no noticeable difference in tracks over the ground between the 3° and 3.2° arrivals or between the 1st and 2nd trial'*. It was further reported that 3.2° arrivals '*no adverse impact on the daily operation'* and *'no impact'* on Heathrow airport's landing rate (1). Indicating that no increase in aircraft holding will arise from the option. Using distance flown (track miles) or time airborne as proxy indicators of fuel burn, there will be no change in fuel burn between the baseline and Option B2.<br><br>**Summary:** Fuel burn will not be a differentiator between the Baseline and the Option B2. |

*Table 5: General Aviation / Commercial Airlines Assessment Criteria*

## 2.6 Commercial Airlines

| Group | Criteria | Type of Analysis | Description |
|---|---|---|---|
| **Commercial Airlines** | **Training costs** | *Qualitative* | **Description:** CAP1616 Appendix E: '*Where a proposal would lead to a need for retraining, this should be quantified and where possible monetised'*.<br><br>**Assessment:** 3.0˚ RNAV approaches are presently operational. Flight trials conducted between 2015 and 2017 reported airlines have '*No issues with 3.2º approach angle'* (1) and '*No detrimental impact due to 3.2º approach*' to ATC (1). No training costs are applicable as the 3.2˚ approach has been in use for two flight trials, conducted between September 2015 – March 2016 (2) and May – October 2017 (1).<br><br>**Summary:** Training costs will not be a differentiator between the Baseline and Option B2. |

 

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| Group | Criteria | Type of Analysis | Description |
|---|---|---|---|
| **Commercial Airlines** | **Other costs** | *Qualitative* | **Description:** CAP1616 Appendix E: '*Where there are likely to be other costs imposed on commercial aviation, these should be described. Where these costs are quantifiable, an assessment should be made'.*<br><br>**Assessment:** No other costs have been identified. 3.0˚ RNAV approaches are presently operational and fleet equipage rates are high (in 2016 the equipage rate was 95%). Furthermore, the use of RNAV approaches remains optional with the introduction of 3.2˚ RNAV approaches. Therefore, operators of unequipped aircraft face no mandatory equipage costs.<br><br>**Summary:** Other costs will not be a differentiator between the Baseline and Option B2. |

*Table 6: Commercial Airlines Assessment Criteria*

## 2.7 Airport/ANSP

| Group | Criteria | Type of Analysis | Description |
|---|---|---|---|
| **Airport/ ANSP** | **Infrastructure costs** | *Qualitative* | **Description:** CAP1616 Appendix E: '*Where the proposal requires a change in the infrastructure, this should be monetised'.*<br><br>**Assessment:** RNAV approaches do not rely on ground-based equipment to determine the final approach vertical and lateral path. No change in infrastructure is required for the implementation of either option and thus no infrastructure costs are incurred by Heathrow airport or the ANSP.<br><br>**Summary:** Infrastructure costs will not be a differentiator between the Baseline and Option B2. |
| **Airport/ ANSP** | **Operational costs** | *Qualitative* | **Description:** CAP1616 Appendix E: '*Where a proposal will lead to changes in operational costs, these should be monetised'.*<br><br>**Assessment** IFP design, validation, AIP promulgation and ATC operational instructions and training have already been completed' as part of the flight trials conducted in 2015 and 2017.<br><br>Flight trials conducted between 2015 and 2017 reported '*No detrimental impact due to 3.2º approach'* to ATC and '*no impact'* on Airport landing rate (1). No further operational costs are applicable to Heathrow airport or ANSP for the introduction of 3.2° RNAV approaches.<br><br>**Summary:** Operational costs will not be a differentiator between the Baseline and Option B2. |
| **Airport/ ANSP** | **Deployment costs** | *Qualitative* | **Description:** CAP1616 Appendix E: '*Where a proposal would lead to a need for retraining and other deployment, this should be quantified and where possible monetised'.*<br><br>**Assessment:** IFP design, validation, AIP promulgation and ATC operational instructions and training already completed. No further deployment costs applicable to Airport or ANSP for the introduction of 3.2° RNAV approaches.<br><br>**Summary:** Deployment costs will not be a differentiator between the Baseline and Option B2. |

*Table 7: Airport/ANSP Assessment Criteria*

 

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## 2.8 Summary

2.8.1 This section summarises the results of the assessment conducted for each category, comparing Option B2 to the Baseline. These are colour coded green and grey, representing positive and neutral assessment outcomes respectively:

| Category | Outcome |
|---|---|
| **Communities** | Average SEL reduction of 0.51 dBA per aircraft on an RNAV approach |
| **Wider Society** | No change in impact |
| **General Aviation** | No change in impact |
| **General Aviation / Commercial Airlines** | No change in impact |
| **Commercial Airlines** | No change in impact |
| **Airport / ANSP** | No change in impact |

*Table 8: Assessment Summary by Category*

## 2.9 Conclusions

2.9.1 The conclusion of the analysis is that Option B2 is the preferred option compared with the Baseline. Option B2 delivers a net benefit compared to the Baseline for the following reasons:

1) Option B2 reduces the average SEL of aircraft on an RNAV approach by up to 0.74 dBA (average at all noise monitoring terminals 0.51 dBA) compared with the Baseline;
2) No construction or other works are required to implement Option B2 compared with the Baseline;
3) No adverse environmental impact of implementing Option B2 compared with the Baseline;
4) No stakeholder groups are adversely impacted by the implementation of Option B2 compared with the Baseline.

 

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# 3. SENSITIVITY ANALYSIS

## 3.1 Introduction

3.1.1 This section contains a qualitative sensitivity analysis illustrating how the preferred option might change as input assumptions change. The following factors have been identified as the most likely to affect the impact of this ACP.

## 3.2 RNAV Usage Rates

3.2.1 The benefits of the proposed airspace change are directly proportional to the number of aircraft flying the slightly steeper RNAV approach.

3.2.2 As discussed in Section 2 of the document '*Heathrow's Slightly Steeper Approach – Stage 2 Gateway Submission*'; RNAV approaches are presently flown by fewer than 2% of Heathrow's arrivals (the remainder land using ILS approaches). The level of RNAV approach usage is primarily due to:

- Greater aircrew familiarity with ILS approaches;
- RNAV approaches are only available in near CAT I conditions or better;
- RNAV approaches result in a higher ATC and pilot workload. Therefore, even if more crews (above 2% of arrivals) elected to fly RNAV approaches, ATC might not be able to accommodate and could decline pilot requests.

Furthermore, the level of RNAV approach usage is also attributable to:

- RNAV approach usage is at the discretion of aircrew and airline policy;
- Not all aircraft are yet equipped to perform an RNAV approach.

3.2.3 Whilst RNAV usage rates are presently low, providing the RNAV usage rate remains positive Option B2 will deliver a net benefit compared to the Baseline.

## 3.3 Traffic Numbers

3.3.1 The benefits of the proposed airspace change are directly proportional to the number of aircraft flying the slightly steeper RNAV approach.

3.3.2 Providing the RNAV usage rate remains positive, Option B2 will deliver a net benefit compared to the Baseline, irrespective of traffic volume.

## 3.4 Noise Reduction

3.4.1 The benefits of the proposed airspace change may vary depending to location and aircraft type.

 

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3.4.2 During flight trials conducted between 2015 and 2017, noise measurements were taken from RMT 129 at Mogden Sewage Works, RMT 130 at Mid-Surrey Golf Course and RMT 131 at Roehampton Golf Club. These are presented below:

| Trial | NMT129<br>Mogden Sewage Works<br>c3.7nm from touchdown<br>c78ft higher with SSA | NMT130<br>Mid-Surrey Golf Club<br>c4.7nm from touchdown<br>c100ft higher with SSA | NMT131<br>Roehampton Golf Club<br>c7.2nm from touchdown<br>c153ft higher with SSA |
|---|---|---|---|
| **Average Differences in Aircraft Noise Events, Sound Exposure Level (SEL dBA)** | | | |
| **First Trial** | -0.25 dB | -0.49 dB | -0.74 dB |
| **Second Trial** | -0.32 dB | -0.55 dB | -0.68 dB |

*Table 9: Stage 2 Noise Results* (1)

3.4.3 Averaged across all aircraft types measured, an average reduction in SEL between 0.25 dBA and 0.74 dBA per aircraft can be expected with the introduction of Option B2.

3.4.4 Providing RNAV usage rate remains positive, Option B2 will deliver a net benefit compared to the Baseline.

 

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# 4. CONCLUSIONS AND RECOMMENDATIONS

4.1.1 The conclusion of the analysis is that Option B2 delivers a net benefit compared to the Baseline. The sensitivity analysis does not identify any situations in which this conclusion would change. The following recommendations are therefore made:

1) Option B2 (Increase RNAV VPA to 3.2˚, maintain ILS VPA at 3.0˚) is carried forward to Full Options Appraisal as the preferred option.
2) The Full Options Appraisal should include sensitivity analyses on the proportion of flights following RNAV approaches and the length of assessment period.

 

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# A Abbreviations

| | |
|---|---|
| **ACP** | Airspace Change Process |
| **AIP** | Aeronautical Information Publication |
| **ANSP** | Air Navigation Service Provider |
| **ANOMS** | Airport Noise Monitoring and Management |
| **ATC** | Air Traffic Control |
| **AQMA** | Air Quality Management Area |
| **CAA** | Civil Aviation Authority |
| **CAP** | Civil Aviation Publication |
| **CDA** | Continuous Descent Arrival |
| **FAS** | Future Airspace Strategy |
| **FOA** | Full Options Appraisal |
| **GA** | General Aviation |
| **GIS** | Graphical Information System |
| **IDT** | Integrated Design Team |
| **IFP** | Instrument Flight Procedures |
| **ILS** | Instrument Landing System |
| **IOA** | Initial Options Appraisal |
| **LAMP** | London Airspace Management Programme |
| **MoD** | Ministry of Defence |
| **NATS** | Primary UK Air Navigation Service Provider |
| **NMR** | National Monuments Record |
| **Nx Contours** | *Nx contours show the locations where the number of events (i.e. flights) exceeds a pre-determined noise level, expressed in dB LAmax.* |
| **RMT** | Remote Monitoring Terminal (Noise) |
| **RNAV** | Area Navigation: *method of instrument flight rules navigation that allows an aircraft to choose any course within a network of navigation beacons.* |
| **SEL** | Sound Exposure Level: *numerically equivalent to the total sound energy.* |
| **VPA** | Vertical Path Angle |
| **WebTAG** | UK Government Online Transport Analysis Guidance Tool |

 